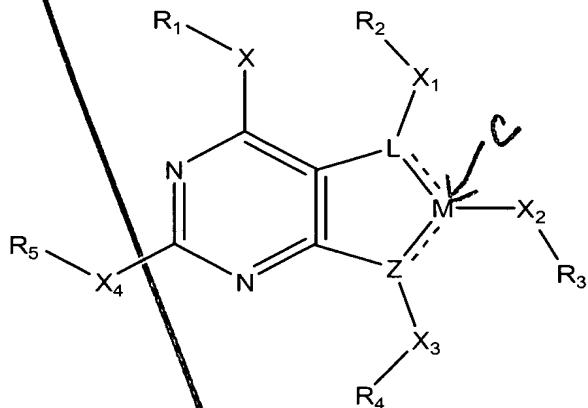


What is claimed is:

1. A compound, and pharmaceutically acceptable salts, solvates and prodrugs thereof, having the formula :



5 where  $X, X_1, X_2, X_3$  and  $X_4$  are from one to about three atoms, are the same or different and are independently selected from the group consisting of hydrogen, an alkyl group, an alkenyl group, an heteroalkyl group and an heteroalkenyl group,

10 and any carbons or nitrogens of said alkyl group, alkenyl group, heteroalkyl group or heteroalkenyl group can optionally be substituted with a straight, branched or cyclic lower alkyl group of from 1 to about 6 carbons;

Z is selected from the group consisting of C, CH, CH<sub>2</sub>, N, NH, S, O, CH=CH, CH=N and N=CH;

15 L is selected from the group consisting of C, CH, CH<sub>2</sub>, N, NH, S, O, CH=CH, CH=N and N=CH, but when Z is C, CH, CH=CH or CH<sub>2</sub> then L is N, NH, S or O;

M is selected from the group consisting of carbon and CH;  
the chemical bond between L and M is selected from the group consisting of a single bond and a double bond, and M is carbon when the bond is a double bond, and M is CH when the bond is a single bond;

the chemical bond between M and Z is selected from the group consisting of a single bond and a double bond, and M is carbon when the bond is a double bond, and M is CH when the bond is a single bond;

but when the bond between L and M is a double bond the bond between M and Z is a single bond;

at least one of R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, or R<sub>5</sub> is present;

R<sub>1</sub>, R<sub>4</sub> and R<sub>5</sub> are the same or different and are selected from group 5 consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group and a substituted alkylheteroaryl group;

R<sub>2</sub> and R<sub>3</sub> are the same or different and are selected from group 10 consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group, a substituted alkylheteroaryl group, and *p*-acetyl-glutamate;

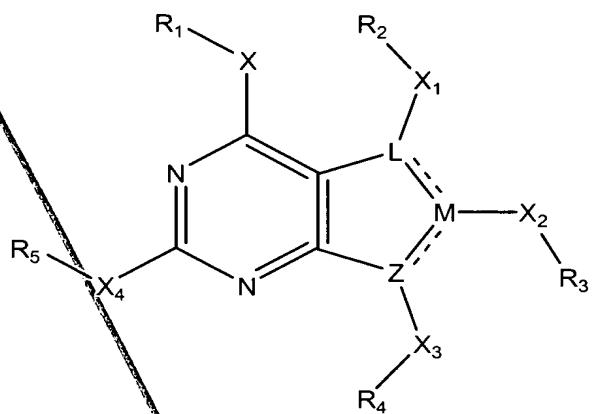
and each substituent of any substituted group is the same or different 15 and is selected from the group consisting of a straight, branched or cyclic lower alkyl, alkenyl or alkynyl group of from one to about 6 carbons, an alkoxy group, an alkoxyaryloxy group, and a halogen.

2. The compound of Claim 1, wherein Z is N.
3. The compound of Claim 2, wherein X<sub>4</sub> is NH<sub>2</sub>.
4. The compound of Claim 3, wherein X is NH and R<sub>1</sub> is *m*-bromobenzene.
5. The compound of Claim 4, wherein X<sub>2</sub> is CH<sub>2</sub>-CH<sub>2</sub>.
6. The compound of Claim 5, wherein R<sub>3</sub> is 2-pyridine.
7. The compound of Claim 5, wherein R<sub>3</sub> is benzene.
8. The compound of Claim 5, wherein R<sub>3</sub> is *p*-methoxy benzene.
9. The compound of Claim 5, wherein R<sub>3</sub> is *o*-chlorobenzene.
10. The compound of Claim 5, wherein R<sub>3</sub> is 1-naphthalene.
11. The compound of Claim 5, wherein R<sub>3</sub> is 2-naphthalene.
12. The compound of Claim 1, wherein Z = O.
13. The compound of Claim 12, wherein X and X<sub>4</sub> are NH<sub>2</sub>.
14. The compound of Claim 13, wherein X<sub>1</sub> is CH=C,

CH<sub>3</sub>

and R<sub>2</sub> is 2-naphthyl.

15. A method of treating a patient with an illness by inhibiting at least one enzyme selected from the group consisting of receptor tyrosine kinase, dihydrofolate reductase and thymidylate synthase, by administering an effective amount of a compound having the formula:



where X, X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub> and X<sub>4</sub> are from one to about three atoms, are the same or different and are independently selected from the group consisting of 10 hydrogen, an alkyl group, an alkenyl group, an heteroalkyl group and an heteroalkenyl group,

and any carbons or nitrogens of said alkyl group, alkenyl group, heteroalkyl group or heteroalkenyl group can optionally be substituted with a straight, branched or cyclic lower alkyl group of from 1 to about 6 carbons;

15 Z is selected from the group consisting of C, CH, CH<sub>2</sub>, N, NH, S, O, CH=CH, CH=N and N=CH;

L is selected from the group consisting of C, CH, CH<sub>2</sub>, N, NH, S, O, CH=CH, CH=N and N=CH, but when Z is C, CH, CH=CH or CH<sub>2</sub> then L is N, NH, S or O;

20 M is selected from the group consisting of carbon and CH; the chemical bond between L and M is selected from the group consisting of a single bond and a double bond, and M is carbon when the bond is a double bond, and M is CH when the bond is a single bond;

the chemical bond between M and Z is selected from the group consisting of a single bond and a double bond, and M is carbon when the bond is a double bond, and M is CH when the bond is a single bond;

5 but when the bond between L and M is a double bond the bond between M and Z is a single bond;

at least one of R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, or R<sub>5</sub> is present;

R<sub>1</sub>, R<sub>4</sub> and R<sub>5</sub> are the same or different and are selected from group consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a 10 substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group and a substituted alkylheteroaryl group;

R<sub>2</sub> and R<sub>3</sub> are the same or different and are selected from group consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a 15 substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group, a substituted alkylheteroaryl group, and *p*-acetyl-glutamate;

and each substituent of any substituted group is the same or different and is selected from the group consisting of a straight, branched or cyclic lower alkyl, alkenyl or alkynyl group of from one to about 6 carbons, an alkoxy group, an 20 alkoxyaryloxy group, and a halogen.

16. The method of Claim 15, wherein said compound is incorporated in a suitable pharmaceutical carrier.

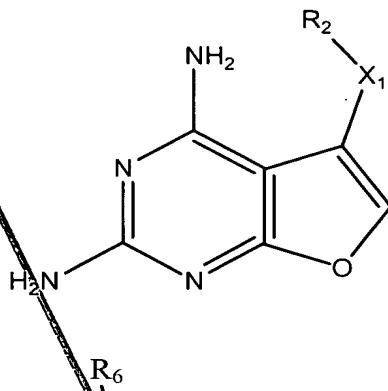
17. The method of Claim 15, wherein said illness is cancer.

18. The method of Claim 15, wherein said illness is selected from 25 the group consisting of infection caused by *Pneumocystis carinii*, *Toxoplasma gondii*, *Mycobacterium tuberculosis* and *Mycobacterium avium*.

19. The method of Claim 16, wherein said carrier is selected from the group consisting of physiologic saline and 5% dextrose for injection.

20. The method of Claim 16, including administering said 30 compound by a method selected from the group consisting of parenteral administration, oral administration and topical administration

21. A compound, and pharmaceutically acceptable salts, solvates and prodrugs thereof, having the formula:



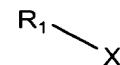
5 where X<sub>1</sub> is CH=C, and R<sub>6</sub> is selected from the group consisting of hydrogen and a straight, branched or cyclic lower alkyl group of from 1 to about 6 carbons;

10 R<sub>2</sub> is selected from group consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group, a substituted alkylheteroaryl group, and p-arylglutamate;

15 and each substituent of any substituted group is the same or different and is selected from the group consisting of a straight, branched or cyclic lower alkyl, alkenyl or alkynyl group of from one to about 6 carbons, an alkoxy group, an alkoxyaryloxy group, and a halogen.

22. A compound, and pharmaceutically acceptable salts, solvates and prodrugs thereof, having the formula:

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Q5*

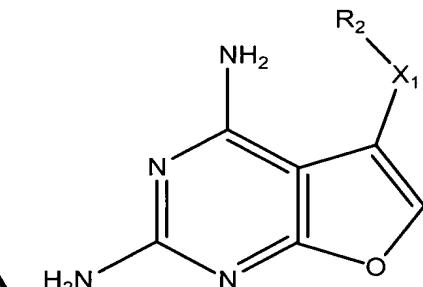


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*15 cost*

where X and  $X_2$  are from one to about three atoms, are the same or different and are independently selected from the group consisting of hydrogen, an alkyl group, an alkenyl group, an heteroalkyl group and an heteroalkenyl group, and any carbons or nitrogens of said alkyl group, alkenyl group, heteroalkyl group or heteroalkenyl group can optionally be substituted with a straight, branched or cyclic lower alkyl group of from 1 to about 6 carbons; at least one of  $R_1$  or  $R_3$  is present;  $R_1$  is selected from group consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, a cyclic aromatic group, a heterocyclic aromatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group and a substituted alkylheteroaryl group;  $R_3$  is selected from group consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group, a substituted alkylheteroaryl group, and *p*-aroylglutamate; and each substituent of any substituted group is the same or different and is selected from the group consisting of a straight, branched or cyclic lower alkyl, alkenyl or alkynl group of from one to about 6 carbons, an alkoxy group, an alkoxyaryloxy group, and a halogen.

23. A method of treating a patient with an illness by inhibiting at least one enzyme selected from the group consisting of receptor tyrosine kinase, dihydrofolate reductase and thymidylate synthase, by administering an effective amount of a compound having the formula:



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where  $X_1$  is  $CH=C$ , and  $R_6$  is selected from the group consisting of hydrogen and a straight, branched or cyclic lower alkyl group of from 1 to about 6 carbons;

10  $R_2$  is selected from group consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group, a substituted alkylheteroaryl group, and *p*-aroylglutamate;

15 and each substituent of any substituted group is the same or different and is selected from the group consisting of a straight, branched or cyclic lower alkyl, alkenyl or alkynyl group of from one to about 6 carbons, an alkoxy group, an alkoxyaryloxy group, and a halogen.

24. The method of Claim 23, wherein said compound is incorporated in a suitable pharmaceutical carrier.

20 25. The method of Claim 23, wherein said illness is cancer.

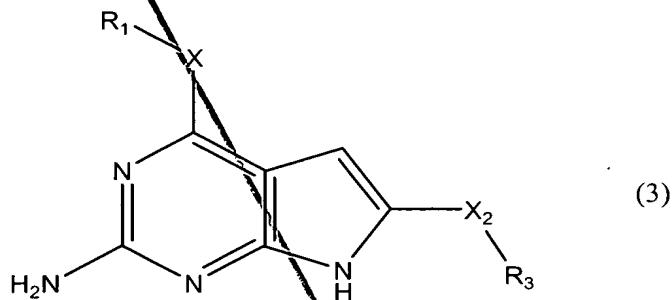
26. The method of Claim 23, wherein said illness is selected from the group consisting of infection caused by *Pneumocystis carinii*, *Toxoplasma gondii*, *Mycobacterium tuberculosis* and *Mycobacterium avium*.

27. The method of Claim 24, wherein said carrier is selected from 25 the group consisting of physiologic saline and 5% dextrose for injection.

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28. The method of Claim 24, including administering said compound by a method selected from the group consisting of parenteral administration, oral administration and topical administration.

29. A method of treating a patient with an illness by inhibiting at least one enzyme selected from the group consisting of receptor tyrosine kinase, dihydrofolate reductase and thymidylate synthase, by administering an effective amount of a compound having the formula:



10 where X and X<sub>2</sub> are from one to about three atoms, are the same or different and are independently selected from the group consisting of hydrogen, an alkyl group, an alkenyl group, an heteroalkyl group and an heteroalkenyl group, and any carbons or nitrogens of said alkyl group, alkenyl group, heteroalkyl group or heteroalkenyl group can optionally be substituted with a straight, branched or cyclic lower alkyl group of from 1 to about 6 carbons; 15 at least one of R<sub>1</sub> or R<sub>3</sub> is present;

20 R<sub>1</sub> is selected from group consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, a cyclic aromatic group, a heterocyclic aromatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group and a substituted alkylheteroaryl group;

25 R<sub>3</sub> is selected from group consisting of hydrogen, a cyclic aliphatic group, a cyclic heteroaliphatic group, an aryl group, a heteroaryl group, an alkylaryl group, a alkylheteroaryl group, a substituted aryl group, a substituted heteroaryl group, a substituted alkylaryl group, a substituted alkylheteroaryl group, and p-aryloyl-glutamate;

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*cont*

and each substituent of any substituted group is the same or different and is selected from the group consisting of a straight, branched or cyclic lower alkyl, alkenyl or alkynyl group of from one to about 6 carbons, an alkoxy group, an alkoxyaryloxy group, and a halogen.

5        30.      The method of Claim 29, wherein said compound is incorporated in a suitable pharmaceutical carrier.

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10        31.      The method of Claim 29, wherein said illness is cancer.

32.      The method of Claim 29, wherein said illness is selected from the group consisting of infection caused by *Pneumocystis carinii*, *Toxoplasma gondii*, *Mycobacterium tuberculosis* and *Mycobacterium avium*.

15        33.      The method of Claim 30, wherein said carrier is selected from the group consisting of physiologic saline and 5% dextrose for injection.

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34.      The method of Claim 30, including administering said compound by a method selected from the group consisting of parenteral administration, oral administration and topical administration.

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*add*  
*A9*